

In the Claims:

Please cancel Claims 14, 17, and 40 without prejudice, amend Claims 1-13, 16, 18-39 and 41-43 as shown below, and add new Claims 24-28 prior to calculating the fees due for this patent application. A complete copy of the claims including marked-up versions of each claim which is amended in this Preliminary Amendment appears below.

1 1. (Currently Amended) A solid state laser gain medium having first and second ends
2 along a laser optical axis in which at least one end is profiled to provide a level of thermal
3 lensing at a predetermined operating power, in which the predetermined beam quality is
4 ~~centred~~ centered substantially on a maximum at the predetermined operating pump
5 power.

1 2. (Currently Amended) A solid state laser gain medium as ~~claimed in claim 1~~
2 defined in Claim 1, in which both ends of the solid state laser gain medium are profiled.

1 3. (Currently Amended) A solid state laser gain medium as ~~claimed in any preceding~~
2 ~~claim~~ defined in Claim 1, in which the solid state laser gain medium is formed of
3 Nd:YAG.

1 4. (Currently Amended) A laser oscillator cavity including a solid state laser gain
2 medium as ~~claimed in any preceding claim~~ defined in Claim 1.

1 5. (Currently Amended) A laser oscillator cavity as ~~claimed in claim 4~~ defined in
2 Claim 4, further ~~comprising~~ comprising:
3 flat cavity end reflectors.

1 6. (Currently Amended) A laser oscillator cavity as ~~claimed in any of claims 3 to 5~~
2 defined in Claim 4, further ~~comprising~~ comprising:
3 a Q-switch having first and second acousto-optic cells and respective first and
4 second non-parallel ~~polarisation~~ polarization orientations.

1 7. (Currently Amended) A laser oscillator cavity as ~~claimed in any of claims 4 to 6~~
2 defined in Claim 4, further including a Q-switch ~~comprising~~ comprising:
3 at least one acousto-optic cell having a reflective end forming a cavity end
4 reflector.

1 8. (Currently Amended) A laser oscillator cavity as ~~claimed in any of claims 3 to 7~~
2 defined in Claim 4, further comprising
3 a frequency converter; and
4 a frequency selective reflector between the solid state laser gain medium and the
5 frequency converter.

1 9. (Currently Amended) A laser including a solid state laser gain medium as ~~claimed~~
2 ~~in any of claims 1 to 2 or a cavity as claimed in any of claims 3 to 8.~~ defined in Claim 1.

1 10. (Currently Amended) A laser as ~~claimed in claim 9~~ defined in Claim 9, further
2 ~~comprising~~ comprising:
3 a side-pumping diode element.

1 11. (Currently Amended) A Q-switch for a laser ~~comprising~~ comprising:
2 first and second acousto-optic cells in respective first and second non-parallel
3 ~~polarisation~~ polarization orientations.

1 12. (Currently Amended) A Q-switch as ~~claimed in claim 11~~ defined in Claim 11,
2 further ~~comprising~~ comprising:
3 a reflective surface arranged to form a laser cavity mirror.

1 13. (Currently Amended) A laser including a Q-switch as ~~claimed in claim 11 or claim~~
2 ~~12.~~ defined in Claim 11.

14. (Cancelled).

1 15. (Original) An optical gain cavity including a gain medium and arranged to operate
2 at a substantially maximum beam quality for a predetermined operating power.

1 16. (Currently Amended) A laser cavity ~~comprising~~ comprising:
2 as a laser cavity ~~element~~, element;
3 a first end ~~reflector~~, reflector;
4 an output end ~~reflector~~ reflector; and
5 a gain medium provided ~~there between~~, between the first end reflector and the
6 output end reflector, the cavity further ~~comprising~~ comprising:
7 as a laser cavity element frequency converter between the gain medium and
8 the output end ~~reflector~~ reflector; and
9 a frequency selective reflector between the gain medium and the frequency
10 converter in which the laser cavity elements are aligned on a common physical
11 axis.

17. (Cancelled).

1 18. (Currently Amended) A laser cavity ~~a claimed in claim 16 or 17~~ as defined in
2 Claim 16, wherein the frequency selective reflector and the output end reflector are
3 arranged to output laser light converted by the frequency converter to be used at a
4 workpiece at the converted frequency.

1 19. (Currently Amended) A laser cavity as ~~claimed in claim any of claims 16 to 18~~
2 defined in Claim 16, in which the frequency converter is a second harmonic generator.

1 20. (Currently Amended) A laser cavity as ~~elaimed in any of claims 16 to 19~~ defined
2 in Claim 16, in which the output end reflector reflects the fundamental frequency
3 generated by the gain medium.

1 21. (Currently Amended) A laser cavity as ~~elaimed in any of claims 16 to 20~~ defined
2 in Claim 16, in which the frequency converter has a large acceptance angle.

1 22. (Currently Amended) A laser including a laser cavity as ~~elaimed in any of claims~~
2 ~~16 to 21.~~ defined in Claim 16.

1 23. (Currently Amended) A laser ablation device comprising a laser as ~~elaimed in~~
2 ~~claim 9, claim 13 or claim 22.~~ defined in Claim 9.

1 24. (Currently Amended) A method of profiling a laser gain medium end ~~comprising~~
2 comprising:
3 ~~to provide~~ providing a level of thermal lensing at a predetermined pump power
4 such that a predetermined beam quality is achieved at the predetermined pump power.

1 25. (Currently Amended) A method of controlling pumping of a Q-switched pulsed
2 laser ~~comprising~~ comprising:
3 reducing pump power to a quiescent level between bursts of laser pulses.

1 26. (Currently Amended) A laser amplifier having:

2 a laser cavity; and

3 an amplifying module external to the laser cavity, said amplifying module sharing
4 a common axis of emission with said laser cavity and comprising a gain medium having
5 first and second ends along said axis of ~~emission~~, emission;

6 whereby at least one of said first or second ends is profiled so as to directly couple light
7 from said laser cavity into said amplifying module.

1 27. (Currently Amended) A laser amplifier as ~~claimed in claim 26~~ defined in Claim

2 26, wherein one or both of said first ~~or~~ an second ends are profiled to form a lens having
3 a predetermined focal length.

1 28. (Currently Amended) A laser amplifier as ~~claimed in claim 26~~ defined in Claim

2 26, wherein said laser comprises a gain medium with profiled ends.

1 29. (Currently Amended) A laser amplifier as ~~claimed in claims 27 or 28~~ defined in

2 Claim 27, in which the lens is one of a refractive lens, a diffractive lens, or a GRIN lens.

1 30. (Currently Amended) A laser amplifier as ~~claimed in claims 27 or 28~~ defined in

2 Claim 27, wherein said laser gain medium ends are profiled to form a lens having a
3 predetermined focal length.

1 31. (Currently Amended) A laser amplifier as ~~elaimed in any of claims 27 to 28~~
2 defined in Claim 30, wherein said lens of said laser gain medium and said lens of
3 amplifier gain medium have substantially equal focal lengths.

1 32. (Currently Amended) A laser amplifier as ~~elaimed in any preceding claim~~ defined
2 in Claim 30, whereby said laser gain medium lens and said amplifier gain medium lens
3 are concavely profiled.

1 33. (Currently Amended) A laser amplifier as ~~elaimed in any preceding claim~~, defined
2 in Claim 26, wherein said laser and said amplifying medium are pumped simultaneously.

1 34. (Currently Amended) A laser amplifier as ~~elaimed in claim 33~~ defined in Claim
2 33, wherein said laser pump and said amplifying pump have equal power.

1 35. (Currently Amended) A laser amplifier as ~~elaimed in any preceding claim~~ defined
2 in Claim 26, in which an input surface to the amplifier is tilted.

1 36. (Currently Amended) An optical amplifier module ~~comprising~~ comprising:
2 a medium having first and second ends, at least one end being profiled to provide a
3 level of lensing at a predetermined operating power, arranged such that, in use, the
4 amplifier can be directly coupled to a laser of predetermined parameters.

1 37. (Currently Amended) A module as ~~elaimed in claim 33~~ defined in Claim 33, in
2 which, for an amplifier medium comprising a rod of diameter D_R , length ~~L_R~~ L_R ,
3 refractive index ~~n_L~~ n_L , ~~in air of~~ refractive index ~~n_{air}~~ of air n_{air} , and thermal focal length
4 f_{th} arranged to receive an input beam from a laser having waist distance d_0 from the
5 input rod end, the rod is profiled with a radius of curvature R given approximately by
6
$$R = \frac{d_0(4f_{th} - L_R)(n_L - n_{air})}{n_L(4f_{th} - L_R - 2d_0)}.$$

1 38. (Currently Amended) A method of making a laser amplifier module gain medium
2 ~~comprising~~ comprising:
3 profiling at least one end thereof to provide a level of lensing at a predetermined
4 operating power, arranged such ~~that~~ that, in use, the amplifier can be directly coupled to a
5 laser of predetermined parameters.

1 39. (Currently Amended) A method of designing a laser amplifier as ~~elaimed in any~~
2 ~~preceding claim~~ comprising identifying a profile as defined in ~~claims 11 or 12~~. Claim 34.

40. (Cancelled).

1 41. (Currently Amended) A method of controlling pumping in a Q-switched, pulsed
2 laser ~~comprising~~ comprising:

3 reducing pump power below the laser cavity lasing threshold prior to full-power
4 pumping.

1 42. (Currently Amended) A method of converting laser frequency in a laser cavity
2 ~~comprising~~ comprising:

3 cooling a frequency converter in the laser cavity to below an optimum frequency
4 conversion temperature while the laser is in a non-lasing state.

1 43. (Currently Amended) A laser assembly comprising a gain medium cavity, ~~laser or~~
2 ~~switch as claimed in any of claims 1 to 22~~ defined in Claim 1 and an amplifier ~~or module~~
3 ~~as claimed in any of claims 26 to 37~~ defined in Claim 26 coupled therewith.